

CLAIMS:

1. A method of extracting a silhouette of an object against a fairly plain background in an image comprising a plurality of pixels, the method comprising:

5 processing the image by determining if adjacent pixels of the image have an equal grey level value, the processing being independent of the numerical values of the original grey level values of pixels of the image.

2. The method of claim 1 wherein the processing
10 comprises:

forming iso-grey regions by partitioning regions of pixels in the image that are adjacently connected and have the same grey level value; and

modifying the grey level value of each iso-grey
15 region to be equal to a new grey level value.

3. The method of claim 2 wherein modifying the grey level of each iso-grey region to be equal to a new grey level value comprises setting the grey level value of the pixels in each respective iso-grey region equal to a number of pixels in
20 the respective iso-grey region.

4. The method of claim 3 wherein iso-grey regions that have a number of pixels less than a selectable threshold value are modified by being assigned another new grey level value that aids in determining a coarse boundary of the object.

25 5. The method of claim 3 wherein for each respective iso-grey region, if the new grey level value is greater than a given threshold value the grey level value of all pixels in the respective iso-grey region is set to a grey level value equal to "white" and if the new grey level value is less than a given
30 threshold value the grey level value of all pixels in the

respective iso-grey region is set to a grey level value within a selected subrange of the full range of grey level values that is proportional to the actual grey level value within the full range of grey levels, the grey level value within a selected
5 subrange aiding in determining a coarse boundary of the object.

6. The method of claim 2 wherein processing the image further comprises:

defining a coarse boundary around the object by analyzing the area outside the object and marking the coarse
10 boundary;

defining the silhouette of the object by analyzing the area within the coarse boundary around the object.

7. The method of claim 6 wherein analyzing the area outside the object comprises moving a detector around the image
15 in an area external to the object and identifying pixels that define the coarse boundary of the object.

8. The method of claim 6 wherein analyzing the area inside the object comprises moving a detector around the image in an area internal to the object and identifying pixels that
20 define the silhouette of the object.

9. The method of claim 7 or 8 wherein the detector comprises a circular shaped region having a radius of one or more pixels.

10. The method of any one of claims 1 to 9 wherein prior
25 to the step of determining if adjacent pixels of the image have an equal grey level value, a further step comprises operating on each pixel of the plurality of pixels in the image to modify the grey level value of each pixel with the purpose of creating iso-grey regions in close proximity to the object that aid in
30 determining a coarse boundary of the object.

11. The method of claim 10 wherein operating on each pixel of the plurality of pixels comprises one of a group of mathematical operations consisting of 1) calculating an average grey level value of a given pixel and the grey level values of pixels adjacent to the given pixel and applying the calculated average to the given pixel for each of the plurality of pixels, 2) calculating a median grey level value of a given pixel and the grey level values of pixels adjacent to the given pixel and modifying the grey level value of the given pixel by applying the calculated median grey level value to the given pixel for each of the plurality of pixels followed by calculating an average grey level value of the modified grey level value of the given pixel and the modified grey level values of pixels adjacent to the given pixel and further modifying the grey level value of the given pixel by applying the calculated average to the given pixel for each of the plurality of pixels, and 3) calculating an average grey level value of a given pixel and the grey level values of pixels adjacent to the given pixel and modifying the grey level value of the given pixel by applying the calculated average to the given pixel for each of the plurality of pixels, calculating a median grey level value of the modified grey level value of the given pixel and the modified pixels adjacent to the given pixel and further modifying the grey level value of the given pixel by applying the calculated median grey level value to the given pixel for each of the plurality of pixels and calculating the average grey level value again of the given pixel and the grey level values of pixels adjacent to a given pixel and yet again modifying the grey level value of the given pixel by applying the calculated average grey level value to the given pixel.

12. The method of claim 6 wherein subsequent to defining a coarse boundary, a further step comprises operating on each pixel of the plurality of pixels in the image to further define the coarse boundary.

13. The method of claim 12 wherein operating on each pixel of the plurality of pixels comprises modifying the grey level of each pixel by using one or more repetitions of a dilation operation, the dilation operation modifying the grey
5 level of each pixel to be equal to a maximum grey level of the pixel and the pixels adjacent to the pixel.

14. The method of any one of claims 6 to 9 and 12 wherein the steps of forming iso-grey regions, defining a coarse boundary and defining the silhouette are repeated to further
10 refine the shape of the silhouette.

15. The method of claim 14 wherein before the steps are repeated a further step comprises operating on each pixel of the plurality of pixels in the image to aid in refining the shape of the silhouette.

15 16. The method of claim 15 wherein the steps are repeated more than once.

17. The method of claim 16 wherein for a first repetition, each pixel of the plurality of pixels in the image being operated on comprises calculating a median grey level
20 value of a given pixel and the grey level values of pixels adjacent to the given pixel and modifying the grey level of the given pixel by applying the calculated median grey level to the given pixel for each of the plurality of pixels followed by calculating an average grey level value of the modified grey
25 level value of the given pixel and the modified grey level values of pixels adjacent to the given pixel and further modifying the grey level value of the given pixel by applying the calculated average grey level to the given pixel for each of the plurality of pixels.

30 18. The method of claim 16 wherein for subsequent repetitions, each pixel of the plurality of pixels in the image being operated on comprises calculating a bias grey level value

of a given pixel and the grey level values of pixels adjacent to the given pixel and modifying the grey level value of the given pixel by applying the calculated bias to the given pixel for each of the plurality of pixels followed by calculating a
5 median grey level value of the given pixel and the grey level values of pixels adjacent to the given pixel and further modifying the grey level value of the given pixel by applying the calculated median grey level value to the given pixel for each of the plurality of pixels followed by calculating an
10 average grey level value of the given pixel and the grey level values of pixels adjacent to the given pixel and yet again modifying the grey level value of the given pixel by applying the calculated average grey level value to the given pixel for each of the plurality of pixels.

15 19. The method of any one of claims 1 to 19 wherein the object is a head and upper torso of a person.

20. A computer readable medium having computer readable program code means embodied therein for extracting a silhouette of an object against a fairly plain background from an image
20 comprising a plurality of pixels, the computer readable code means comprising:

code means for processing the image, the processing comprising determining if adjacent pixels of the image have an equal grey level value, the processing being independent of the
25 numerical values of the original grey level values of pixels of the image.

21. The computer readable medium of claim 20, the computer readable code means further comprising:

code means for forming iso-grey regions by partitioning regions of pixels in the image that are adjacently connected and have the same grey level value; and

code means for modifying the grey level value of each
5 iso-grey region to be equal to a new grey level value.

22. The computer readable medium of claim 21, the computer readable code means further comprising:

wherein the code means for modifying the grey level of each iso-grey region to be equal to a new grey level value
10 comprises code means for setting the grey level value of the pixels in each respective iso-grey region equal to a number of pixels in the respective iso-grey region.

23. The computer readable medium of claim 22, the computer readable code means further comprising:

15 code means for setting the grey level value of all pixels in the respective iso-grey region to a grey level value equal to "white" if the new grey level value is greater than a selectable threshold value; and

code means for setting the grey level value of all
20 pixels in the respective iso-grey region to a grey level value within a selected subrange of the full range of grey level values that is proportional to the actual grey level value within the full range of grey levels if the new grey level value is less than a given threshold value;

25 the grey level value within a selected subrange aiding in determining a coarse boundary of the object.

24. The computer readable medium of claim 21, the computer readable code means further comprising:

code means for defining a coarse boundary around the object by analyzing the area outside the object and marking the coarse boundary;

code means for defining the silhouette of the object
5 by analyzing the area within the coarse boundary around the object.

25. The computer readable medium of claim 20, the computer readable code means further comprising:

code means for operating on each pixel of the
10 plurality of pixels in the image to modify the grey level value of each pixel with the purpose of creating iso-grey regions in close proximity to the object that aid in determining a coarse boundary of the object.

26. The computer readable medium of claim 24, the
15 computer readable code means further comprising:

code means for operating on each pixel of the plurality of pixels in the image to further define the coarse boundary.

27. The computer readable medium of claim 24, the
20 computer readable code means further comprising:

code means for initiating repeating the steps performed by the code means for forming iso-grey regions, defining a coarse boundary and defining the silhouette to further refine the shape of the silhouette.

25 28. The computer readable medium of claim 27, the computer readable code means further comprising:

code means for operating on each pixel of the plurality of pixels in the image to aid in refining the shape of the silhouette.